CATEE 2017

Ensuring Efficiency is Present Through Construction

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Brandon Boyter – Executive Director of Facilities for Allen I.S.D.

- with Allen ISD for one year
- Previous ten years with Frisco ISD as the construction project coordinator.
- Over the last ten years have been a part of 45 new school builds including:
  - 26 elementary schools - 10 Middle Schools
  - 5 high schools - 2 HS renovations
  - Allen HS (currently right at 1 million square feet) doing a 4 phase renovation.

What does the title mean?

"Ensuring Efficiency is present through **construction**"

- Making sure efficient design is present when doing construction projects.

- In a fast paced environment when construction is going on so rapidly how do you keep the goals of energy efficiency at the top of the list?

- **In a renovation project how do I affect energy savings?**

- How we can we save $$$ (Energy) on the backside making smart decisions on the front side.

- **We don't build very often how can we make sure we make the right decisions about our new building?**

This presentation will take a look into all of the questions above and hopefully show how making smart decisions during construction and during renovations can save on energy and pay off during the ownership of the facility.

2 important cost during construction & renovation projects

- **Cost of ownership**
- **Initial building cost.**

Do you understand the implications that your selections have on the energy efficiency of the building?

How do my decisions effect energy usage?

How does your decision affect the cost of ownership of the facility?

The **cost of ownership** of school facilities is sometimes **overlooked** when they are **designed and built**. Most districts will operate and maintain their facilities for 25 to 50 years and in some cases even longer. It makes sense to **invest** in quality materials, **energy-efficient equipment** and a solid **maintenance program**.

CATEE 2017

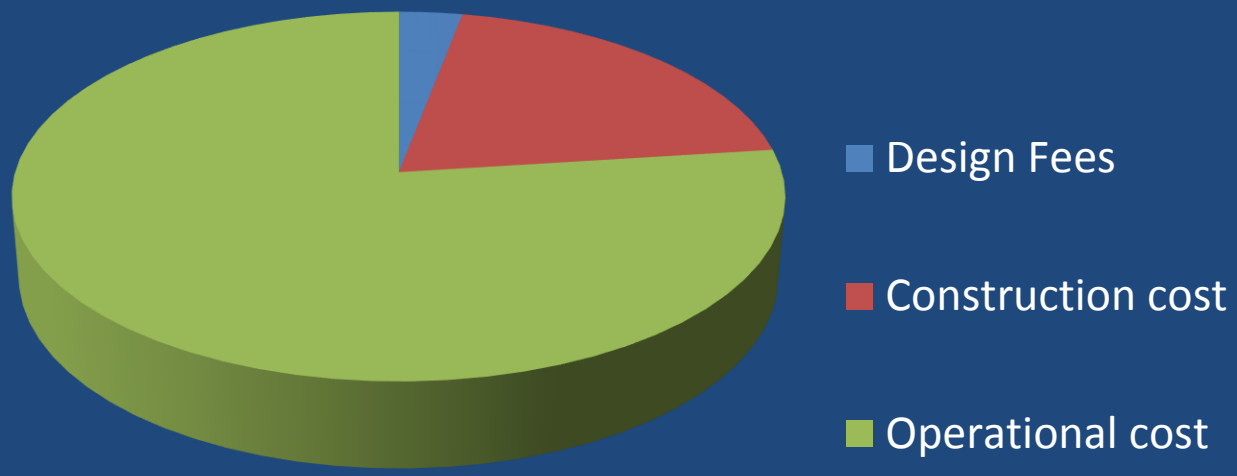
What makes up **initial building cost**?

Site cost	Hard cost	Soft cost
Land cost	**Foundation**	Architect fees
Surveys	**Structure**	Management Fees
Fees	**Envelope**	Legal fees
	M.E.P. Systems	FFE
	INTERIOR FINISHES	
	Technology systems	

hard cost influence your **initial cost & cost of ownership** more than any other item

What makes up total cost of ownership?

Total Cost of Ownership is the total cost of owning an asset over a period of time. In the construction industry this usually means the total cost of **designing**, **constructing**, **operating**, & **maintaining** a facility throughout its **useful life.**



So how do I **affect** the **OPERATIONAL COST** of my new facility during construction?

So the ~~BIG~~ **Million dollar Question** is?

How do I make the **correct decisions** about **HARD COST** so I impact the **cost of ownership** in a **positive way?**

So how do I save money down the road by making the correct decisions now!!

Operational savings start during the **design phase** of the **construction project.**

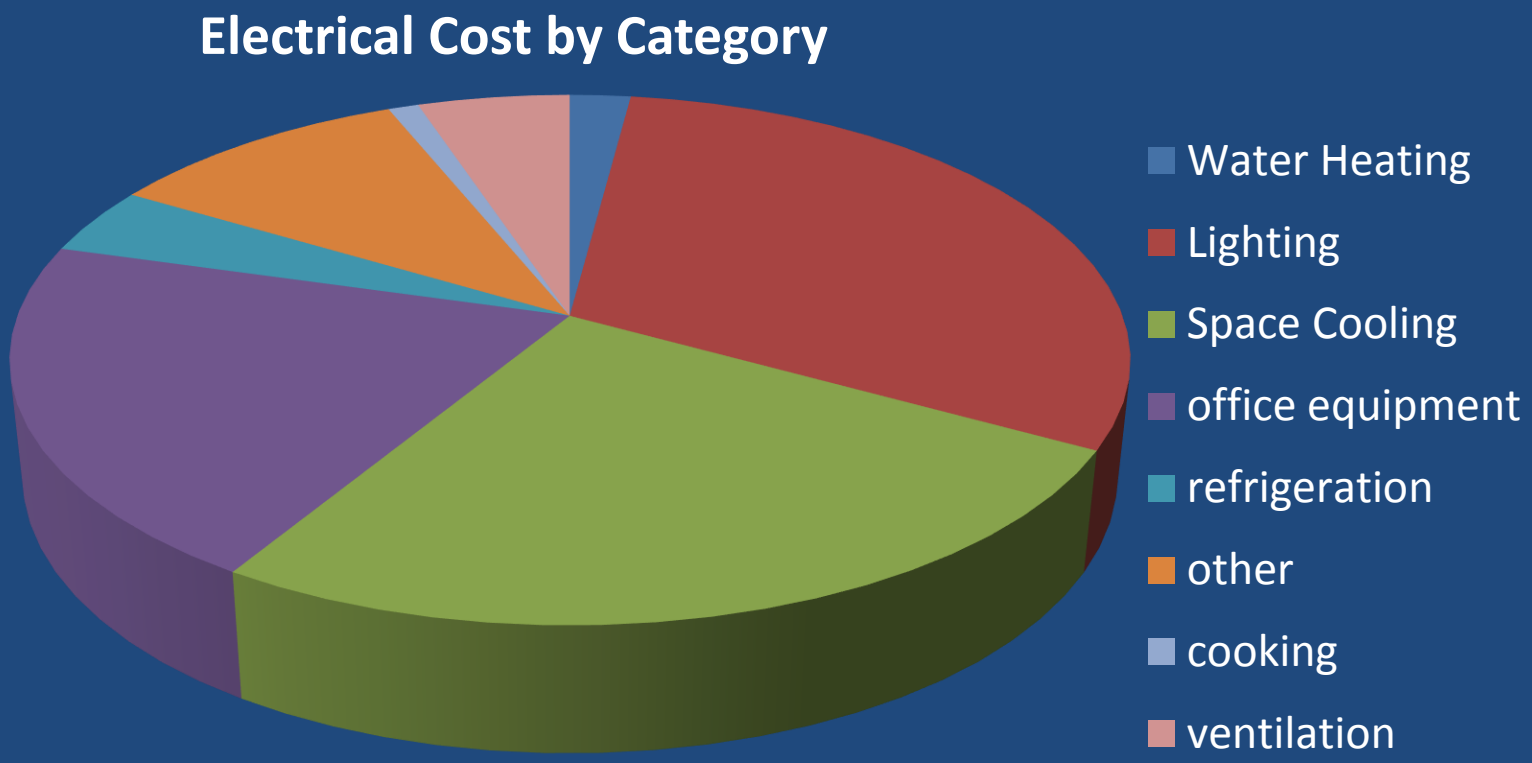
During the rush to construct new buildings, schools often focus on **short-term construction costs** instead of **long-term cost** such as: maintenance cost life-cycle cost & energy savings. **The key** to getting an energy-smart and well-designed school **is to ~~ask for~~ DEMAND an energy-efficient design** built with **materials** that are **easier to maintain.**

How do I know what to ask for?

….Where do schools use most of their energy?

Where is energy used in schools?

K-12 buildings in the U.S. spend over a $1 dollar per square foot (ft2) on electricity and over .19 cents/ft2 on natural gas annually.



3 Largest Users of Energy in schools

Lighting

HVAC

Plug load

K-12 schools spend more than $6 billion a year on energy — about 25 percent more than necessary — more than is spent on textbooks and computers combined.

The least efficient schools use three times more energy than the best energy performers; and

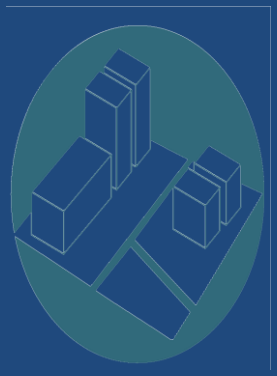
Top performing ENERGY STAR labeled schools cost forty cents per square foot less to operate than the average performers.

- Department of Energy

The **conventional design process** usually evaluates energy-efficient technologies late in the schematic design or during design development. However, the greatest opportunity for cost-effective **energy measures** occur **earlier in the design process..**

DESIGN STRATEGIES TO SAVE ENERGY

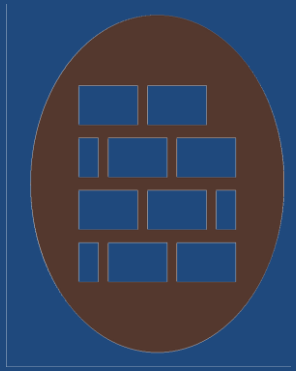
SITE SELECTION



BUILDING ORIENTATION

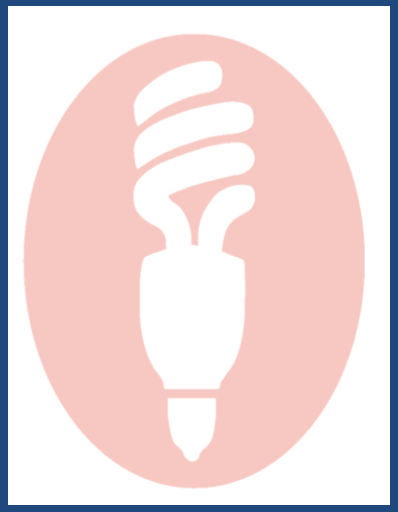
MECHANICAL SYSTEMS

EFFICIENT BUILDING ENVELOPES



LOW MAINTENANCE MATERIALS AND SYSTEMS

ADDITIONAL STRATEGIES



ENERGY

MODELING

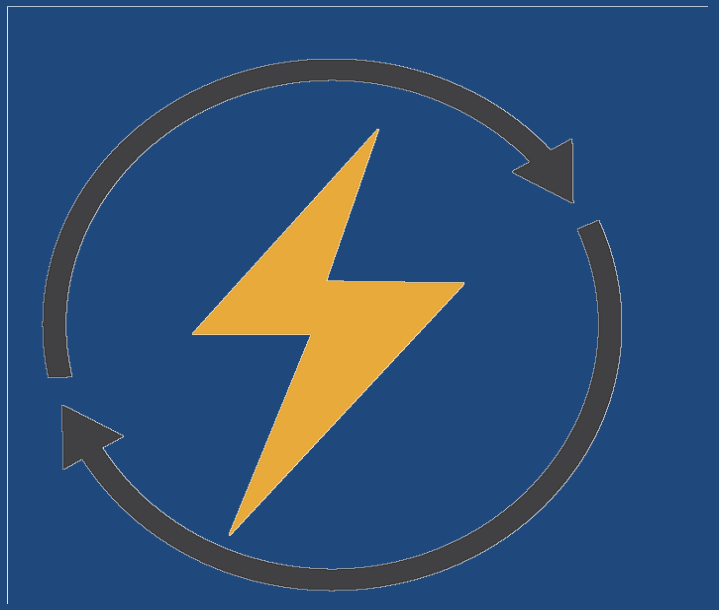
CLOSE COLLABORATION

Commissioning

DESIGN & CONSTRUCTION TEAM, OWNER & END USER & RE-COMMISSIONING OLDER BUILDINGS

WHICH SYSTEMS ARE THE BEST?

EASY TO MAINTAIN



ENERGY EFFICIENT

FITS SITE RESTRAINTS

MEETS BUDGET LIMITATIONS

25-30%

TOTAL

energy consumption

ARTIFICIAL LIGHTING

AUTOMATIC DAYLIGHT HARVESTING

VACANCY SENSORS

DUAL CONTROLS

LED LIGHTING

NATURAL LIGHTING

SEEING THE LIGHT

CAREFUL CONSIDERATION OF A COMBINATION OF ARTIFICIAL AND NATURAL LIGHTING

SEEING THE LIGHT

TYPICAL LED LIGHT CLASSROOM

0.513 W/SF

TYPICAL FLUORESCENT CLASSROOM

0.963 W/SF

CAREFUL CONSIDERATION OF A COMBINATION OF ARTIFICIAL AND NATURAL LIGHTING

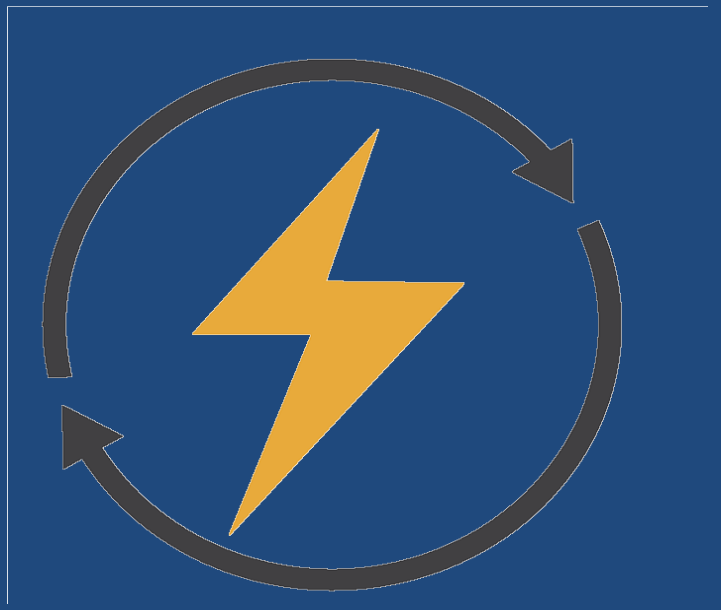

SAVE ENERGY SAVE MONEY SAVE THE ENVIRONMENT
Did you know?
GENERAL ELECTRIC
SINGLE-PHASE WATTHOUR METER
TYPE I-50-S
KILOWATTHOURS
15 AMPERES 240 VOLTS 3 WIRE K 3.6
60 CYCLE R 2755 MODEL AR1
29 339 363
Using energy efficient products
Saves Dollar
Using energy
efficient produc
Saves Effort.
Using energy efficien
products helps Save th
for Tuckaseg Energy Cooperative

- After **lighting**, **mechanical systems** account for the most **ENERGY** usage of buildings.
- Indoor air quality has a great effect on energy usage plus student performance and attendance

FEEL THE COMFORT

WHICH SYSTEMS ARE THE BEST?

Maintain with school staff



ENERGY EFFICIENT

FITS SITE RESTRAINTS

MEETS BUDGET LIMITATIONS

HVAC SYSTEM ONE OF THE LARGEST ENERGY USAGES

Just makes sense – the more **energy efficient system** you install…….the more **energy** you can save over the **life** of the facility.

If a **system costs less** to **maintain** …..the **more money you save** over the life of the system and thus over the life of the facility.

GEOTHERMAL BENEFITS

Small chillers have cooling efficiencies close to .6 KW/ton but typically are closer to 1.0 KW/ton or 3.5 Coefficient of Performance

Energy Star GHP have a 17.3 to 26.5 EER and Coefficient of Performance range from 3.8 to 5.2

The average efficiency for an electric boiler is 96 percent, while a typical natural gas unit would have an efficiency of 85 percent. GHP efficiency, by contrast, can be as high as 300 percent.

- Lower maintenance cost
- No chemical treatment to the water
- No carbon monoxide

GEOTHERMAL RETROFIT PROJECTS

In the summer of 2016 three elementary schools in Frisco ISD were converted from central plant hvac system to ground source heat pumps.

Building 1 –

previous year usage for July thru October 2016 329,360 KWH - $33,381.22

After conversion July thru October 2017 251,760 KWH - $21,537.59

Building 2 –

previous year usage for July thru October 2016 312,000 KWH - $32,665.46

After conversion July thru October 2017 226,400 KWH - $23,705.60

Building 3 –

previous year usage for July thru October 2016 272,480 KWH - $25,846.60

After conversion July thru October 2017 245,680 KWH - $19,962.79

energy savings in **4 months** of **190,000 KWH - $26,839.00**

GEOTHERMAL HVAC BENEFITS

Typical Maintenance Costs

Compressors

WSHP Compressor	$850
Chiller Compressor	$10,000

Water Treatment

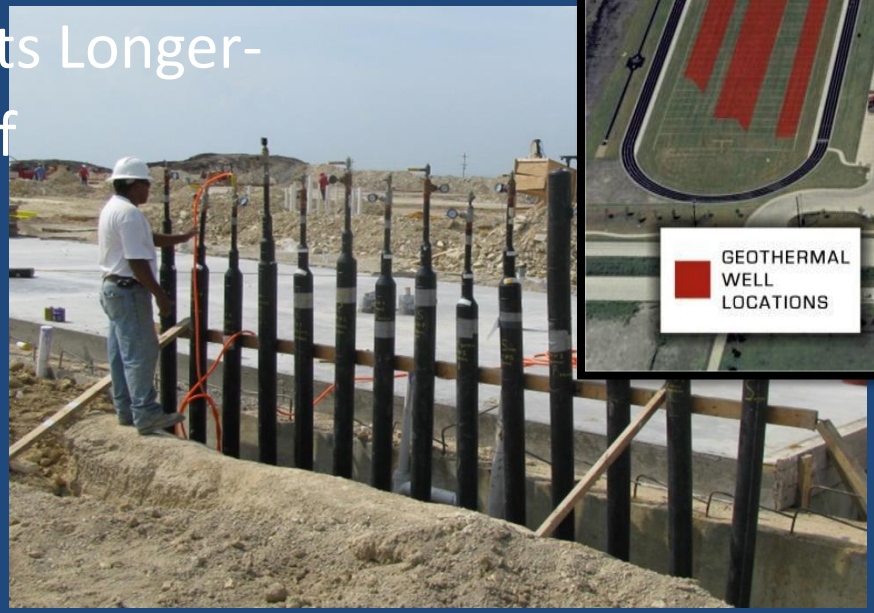
Geothermal Loop	$0.00
Central Plant	$ 6,500

Water Pump

Geothermal	$560
Central Plant	$4,000 to 6,000

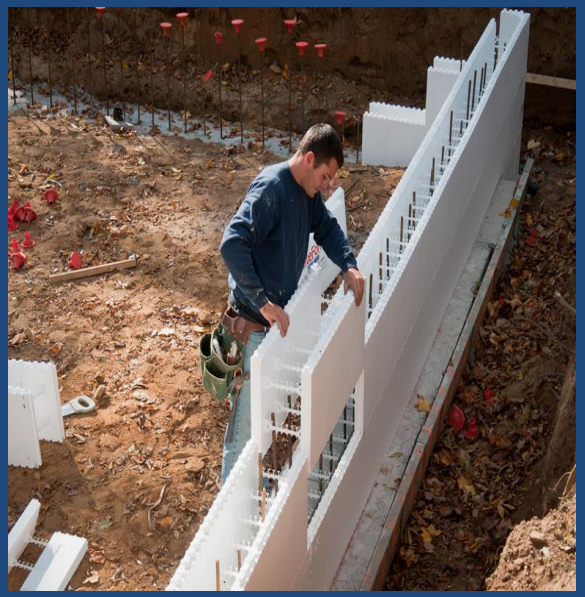
Equipment Lasts Longer-

Not on the roof



SPRAY FOAM INSULATION

ENERGY STAR RATED ROOF



INSULATED CONCRETE FORMS

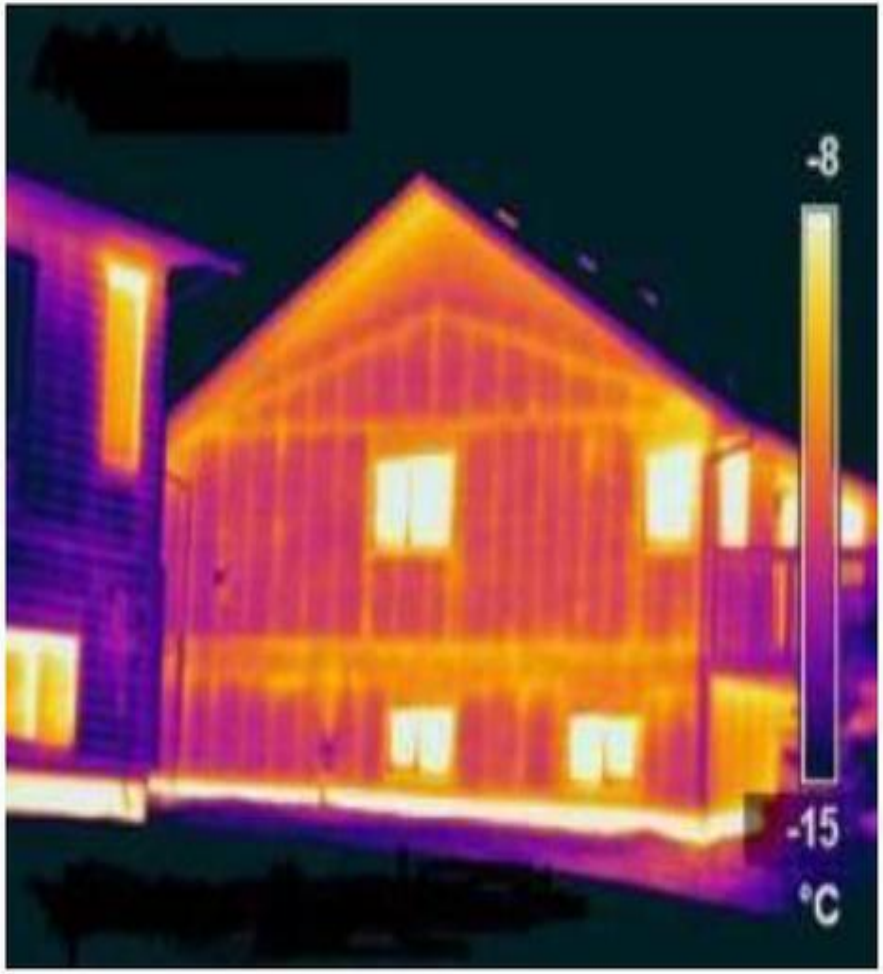
Energy Code had driven most new construction projects to be more energy efficient.

Energy code mandates continuous insulation.

BUILDING ENVELOPE

BUILDING ENVELOPE - EXAMPLE OF THERMAL BRIDGING

2 X 6 Framed Wall with R-19 Batt



ICF Wall

BUILDING FINISHES & components

- **Historically** our **focus** when building buildings has been on the **initial cost** of the building.

Why would anyone **pay more?**

Goal would be to move to a **total cost view** when making decisions **on components** going into our facilities.

Benefit of this **goal**……**shift $$$$$** from **operational cost** to **capital cost!!!**

Building Finishes – Athletic Renovation

- All surface running track needs to be resurfaced. comparison of products

Product type	Re-surface cost	Lifespan	Re-surface cost	Paint lines every 3	Year 6	Year 12	Year 16-18
Structural spray	$165,000	Re-spray surface every 6 years	$110,000		$286,500	$409,500	$526,000
Full pour track 10mm	$243,000	Based on material need typical life expectancy is 15-20	$185,000	$6500	$256,000	$269,000	$282,000

Increased cost of $78,000

Savings after year 6 - $30,500

Savings after year 12 - $140,000

Total savings over 15 years - $248,000

Building Finishes

The chosen **finishes** can provide **substantial savings** over the life span of a facility based on **cost of ownership**.

One example is **VCT flooring** vs. carpet flooring

VCT initial cost to **install $1.85** per square foot

VCT cost per square foot per year to **maintain $1.08**

Cost of ownership over 15 years - **$20.61 sq. ft.**

Carpet cost to install per square ft. **- $3.75**

Carpet cost to maintain per square ft. **- $.55**

Carpet cost of **ownership** per square ft. - **$16.95**

Chose fifteen years based on district standard of renovation schedule

Building automation controls

These are the four core functions of a building automation system:

1. To **control** the building **environment**
2. To **operate** systems according to **occupancy and energy demand**
3. To **monitor** and correct **system performance**
4. To **alert** or sound alarms **when needed**

At optimal performance levels, an automated building is greener and more user-friendly than a non-controlled building.

Building automation controls

Why do we **install** them? **#1** reason….to **save energy**

Pitfalls of energy management systems:

- Set district standards of control
- Limit who can make changes to the system and track those changes
- Conduct schedule reviews of each building – all are not used the same
- Make sure schedules take into account the different zones.
- Don’t deviate
- RE-CHECK all settings and schedules
- Remember to account for time change.

- **District standards** in collaboration with staff
- Energy management plan
- Clear goals and baseline analysis to assess savings
- Community and student involvement for representation energy data
- Systematic energy audits for control of energy costs
- Paying attention to the energy bill

Remember long after the architects and contractors have ridden off on their white horses, We are the ones that will be left to take care of the building.

IT TAKES A VILLAGE

COLLABORATION

DIFFICULT CONVERSATIONS

You cannot discuss how the building will be ***efficiently designed***… without talking about how the building will be ***efficiently used***.

Energy efficient design can have a truly positive effect on our schools. In these times of increased financial scarcity and scrutiny, thoughtful approaches to energy savings can help direct resources back to personnel and students creating a meaningful impact on students, schools, districts and communities.

COMMUNICATION ABOUT BUILDING USE

In closing….How to ensure **efficiencies** are present through **Construction.**

Set Standards in design & usage

Main energy hogs Lighting - HVAC

Use materials that require less maintenance

Am I being the best steward of the taxpayers dollars?

Q?

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